TOPSOIL

ITS PRESERVATION

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
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Good Soil Builds and Sustains Good Homes

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Good Farmers and Soil Conservation

THROUGHOUT the Middle West erosion and exhaustive systems of cropping have taken a terrific toll from the soil. These losses have been so great that we no longer have a comfortable margin of safety for the man on the land or for the maintenance of the highest degree of public welfare. From now on we can be assured that one of the basic requirements of a good farmer is that he shall preserve the soil.

In stressing the importance of soil conservation there seems to be a prevailing impression that the results of such conservation efforts will, after all, be of value only to the generations to come. However, there is little doubt that with the exception of rather small areas of the very best uplands and some of the alluvial lands of the country, systems of land use which allow the soil to continue to deteriorate are not the most economic systems for the good farmer.

It is to the farmer's interest, both from the standpoint of economic returns and the maintenance of a satisfactory standard of living, that he adjust his methods of land use so as to conserve the soil. From this time forth the prosperity of the good farmer on his individual farm will be assosiated with soil-conserving methods. The great problem is to find a way of convincing the majority of the farmers that this is true.

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NATURE, if left undisturbed, clothes the soil with a protective mantle of vegetation. When our ancestors explored our eastern shores about 300 years ago they found a dense forest growth and no apparent erosion of the soil. Streams most of the time were clear and sparkling.

Trees, with their canopy of foliage, break the force of raindrops. Trees send countless roots into the earth which help to hold the soil in place. Trees annually renew the filter pad of leaves and twigs on the forest floor through which raindrops trickle slowly into the absorptive humus-charged soil beneath.

An Illinois wood lot is pictured here. On the left of the fence dividing the grove we see dense reproductive undergrowth that has been protected from grazing. Find the man. On the right side of the fence we can see the man plainly because grazing livestock have destroyed the undercover.

Woodlands provide little pasture, and if animals are allowed access to them they make it difficult for the trees to renew the protective covering of vegetation.

PUSHING westward our ancestors found fewer trees but more grass, principally prairie grasses. Like trees, grass effectively anchors soil against erosion. Fibrous, close-growing roots lash the soil in place and decaying plant residues make an absorptive sponge to hold water. Innumerable blades and stalks prevent pounding raindrops from striking the soil particles. Water flowing downhill over grassland encounters a myriad of tiny checks. The water flow is retarded. Slow-moving water does little or no damage.

At the Soil Erosion Experiment Station, Bethany, Mo., a plot of grass lost only 9 percent of the rainfall and about one-third of a ton of soil per acre, during an experimental period. An adjacent plot, same slope, but bare of vegetation, lost 31 percent of the rainfall and 113 tons of soil per acre.

The bromegrass waterway shown above is doing the job it is expected to do—protecting the soil against rushing water from the adjoining cultivated flelds. This grass, seeded in 1917, withstood the 1936 drought but it was not pastured. Nineteen years ago Joseph E. Wing, of Ohio, wrote Ida M. Fisher, Shenandoah, Iowa, who operates this farm: "Judiciously grazed bromegrass crowds out bluegrass. Injudiciously grazed bluegrass will crowd out the brome."

WITH AX in hand, matches in their pockets, and a ready plowshare our forefathers quickly upset nature's unexcelled method of protecting the soil. A growing and expanding country called for food beyond the immediate requirements of those living on the land. Forests were leveled with the ax and burned. Plows turned the original forest soil and prairie sod for the growing of cultivated crops.

Dashing rain on the bare, but formerly well-protected, fields had little effect at first. But continuous cropping of even an incredibly rich soil will take its toll. Plant food goes, humus is depleted, and erosion begins.

Sheet erosion is the most damaging of all forms of erosion. It starts first, but usually the damage is recognized least. Water flowing over the surface removes thin sheets of topsoil. Often it goes unnoticed until lighter colored spots appear on the upper parts of cultivated slopes. Sheet erosion is not always as easily recognized as it is in the field shown below. Frequently rocks become exposed because they are no longer covered by a thick layer of topsoil.

EROSION surveys reveal that 50 million acres of land in the United States has been ruined by erosion. Many other acres are approaching impoverishment.

Gullies represent an advanced form of erosion. Gully erosion is easily seen and the havoc is readily apparent.

Gully erosion follows in the path of sheet erosion; the rate of destruction is often hastened when crop rows are laid in straight lines up and down the slopes. Each little furrow left by a tillage tool makes a downhill runway for silt-laden water. Throughout winter months, if the ground is not frozen, gullies widen and deepen with each heavy rain.

Gullies often start between corn rows which run up and down a slope. When fields are severely gullied like the one shown above they are often turned into pastures. Yet many gullied pasture fields are so heavily grazed that vegetation has no opportunity to check the chiseling effect of erosion.

THIS southwestern Iowa farmer found 20 inches of silt deposited in his pasture field following one heavy rain in the late spring of 1936.

Deposits of silt from uplands may be a temporary benefit. The fertility of valley fields is often replenished by topsoil carried down in rushing water from higher slopes. This observation frequently leads to erroneous conclusions. These comments are occasionally heard: "The soil washes from my fields but it doesn't leave the farm. I get it all on my lower land." Another says: "The soil I lose goes down to my neighbor—my loss is his gain."

When erosion has etched its way through the productive topsoil on the higher slopes, disaster is knocking at the door. As more subsoil is carried down and piled on top of rich soil in the lower land crops are more difficult to grow on bottoms. One man's loss may be another's disaster.

THE picture here tells its own story. Throughout the country men have dug into the earth's surface to make similar comparisons. In virgin spots—churchyards, schoolyards, and forests—they have measured the depth of the original topsoil. Climbing over fences, they have made similar measurements in cultivated fields only a few feet away. Losses of productive topsoil, they find, vary from very little to practically all.

When settlers nosed their plowshares into the rich cornland of the Middle West about 70 years ago, they turned a soil which grew crops exceeding all reasonable expectations. Decade after decade good crops were harvested. The belief crystallized that the land "can't be worn out." But—"Much of the cream has been taken off this land", a reflective Illinois farmer observes.

Harmful erosion is at work. Recent surveys, by the Soil Conservation Service, in each of the five States in the upper Mississippi Valley area, reveal harmful soil losses. On a percentage basis the report shows that 40 percent of the land area in Illinois is damaged by erosion; 57 percent in Iowa; 45 percent in Minnesota; 75 percent in Missouri and 45 percent in Wisconsin.

A DIRT-FILL dam was built across the small river near Hokah, Minn., 75 years ago. When completed the impounded water formed Lake Como which supplied power for the railroad shop and a flour mill. But it did more; the natural beauty spot became a famous summer resort. Flood waters caused by frequent heavy rains in 1909 tore out the earth embankment. Lake Como became a dry run, but in 1922 a new dam was built to impound water for Lake Como the second.

In 1926 a photographer took the picture shown above. Note the diving board and the marked-off swimming beach.

Ten years later, in the summer of 1936, another photographer, with the above picture in hand, sought the same spot. Buildings, roads, trees, and the outline of distant hills—but not the lake—revealed the location. The picture on the right shows where Lake Como used to be.

THE LAKE bed is now a mud flat overgrown with weeds. Silt from steep cultivated and deforested slopes filled the lake in 10 years. Loss of soil and water from the uplands has been a detriment to agriculture and the silt in the lake bed deprived industry of water power.

THE PRECEDING pictures and discussion in this publication reveal the causes and extent of damage due to destructive erosion.

Succeeding pictures and text will reveal what man is doing to hold soil and water on the land. Many of the erosion-control practices recommended and employed by the Soil Conservation Service are illustrated in the pages which follow.

THE THREE Iowa farmers pictured below are spreading limestone to help insure a clover stand.

Lime is removed from soils by leaching, erosion, and continuous cropping. When lime is removed the soil becomes acid or sour and legumes do not thrive well. Legume stands are more certain after lime is returned to the soil. Legume crops resist erosion. Lime also causes the small particles of clay and silt to group into larger particles, forming a more porous soil structure, which in turn helps to prevent erosion.

Lime helps to maintain a rotation of crops. Crops growing in rotation with a legume more effectively prevent soil losses. When corn is grown continuously, soil losses mount. At the Soil Erosion Experiment Station, Bethany, Mo., 68.8 tons of soil were lost per acre each year from land in continuous corn over a 5-year period. On the same 8-percent slope, under the same rainfall, land in a rotation of corn, wheat, and clover lost but 11.4 tons of soil. The water loss on the land in corn continuously was 28.3 percent of the total precipitation as compared with 15.2 percent on land planted to crops in rotation.

THIS ILLINOIS farmer is plowing under a green-manure crop to replenish the supply of organic matter in the soil.

Humus is partially decayed organic matter. In the soil it acts like a sponge. Muck soils, which are heavily charged with humus, will absorb so much moisture that water can be squeezed from them by hand. By adding humus to the soil its absorptive capacity is increased, and less water runs over the surface as destructive run-off.

Green-manure crops improve the soil structure and supply much readily available plant food, which boosts crop yields and stimulates vigorous growth of roots. This aids in reducing erosion.

Most legumes are good green-manure crops. Sweetclover and alfalfa are especially valuable. Since much of the land in the upper Mississippi Valley is acid, and since alfalfa, sweetclover, and certain other legumes cannot be grown successfully on sour land, the application of pulverized limestone often must precede an attempt to grow a green-manure crop.

BY CONTOUR farming is meant farming around the hill and not in straight parallel lines suggested by roads and fences. One is guided, in farming on the contour, by the natural slope of the land. Each small ridge and furrow thrown up by implements going around the hill on the level, helps to hold water where it falls, thus reducing run-off. On the other hand, as in straight-row property-line farming, small furrows running up and down the slope are troughs which carry silt-laden water rapidly downhill.

To strip crop, one plants bands or strips of close-growing crops on the contour alternating with strips of cultivated crops. The close-growing crops include most of the legumes, grass, and small grains.

Above is a sky view of a Winona County, Minn., farm strip cropped on the contour. Prior to 1936 this land had been farmed "with the fences", which meant up and down the slopes in many parts of fields. Sheet and gully erosion have been reduced. Crops would not have done so well in 1936, a drought year, had not the practice of strip cropping on the contour conserved water. The picture was taken in August.

STRIPS OF close-growing crops filter out the soil particles from silt-laden water running down from above. The flow of water is checked because it meets innumerable obstructions. Slow-moving water drops its load, and the water is given more time to soak into the ground.

Strips of row crops, like corn and potatoes, offer less resistance to water flow during heavy downpours. But if row crops are protected against the wash from above by a strip of a close-growing crop, and if there is another strip below ready to slow down the moving water, little soil is likely to move from the field.

In June 1936 the Harrison County, Mo., field shown below, had strips of wheat, oats, and corn on the contour. In the immediate foreground is the wheat. Oats come next in strip 2, corn in strip 3, and oats again in the strip below the corn. Wheat was planted in the irregular strip close to the fence instead of corn in order to eliminate the need to cultivate point rows of corn.

TERRACING is another method of conserving soil and water. Terraces act as impediments to the downhill flow of water. But a properly constructed terrace system does more; terraces slowly carry surplus water off the field in an orderly manner and discharge it into outlets protected by vegetation or appropriate structures. Terraces break up the slope in a field into sections so that surface run-off does not flow so rapidly. For example, if water is allowed to flow down an unprotected slope 100 yards long it gains a high velocity by the time it reaches the bottom. Fast-moving water is very erosive. Terraces on a long slope break it into a series of short slopes.

Terraces are constructed principally on cultivated fields which have a slope greater than 1 percent, that is, a fall of 1 foot in 100 feet. The maximum slope on which terraces may be used satisfactorily varies from 8 percent to 15 percent, depending upon the type of soil, topography, farming methods, and crops grown. Terraces used in pastures are not as large as the broad-base type generally built on cultivated land in this region. Pasture terraces are usually level with no outlet.

ON THE PAGE to the left are shown terraces under construction on an Illinois farm. Note the tractor and grader at the extreme left. The terraces in this field, built in December 1934, run almost parallel because the slope is nearly uniform. Above are shown the same terraces retaining surplus water after a heavy rain. Note how water has accumulated in the broad channel just above each terrace ridge. Some of this water will soak into the ground and some of it will flow gently to the terrace outlet.

Terraces alone are not sufficient to control erosion satisfactorily on sloping land; they must be used in connection with good cropping practices. In this field, strips of oats are alternated with strips of cultivated crops. Both the crop strips and the terraces follow the contour lines of the field.

Terraces must be properly built but it is just as important, perhaps more so, to provide adequate outlet channels.

IN THEIR younger days gullies seem harmless as was true of the Iowa gully pictured below. Rushing water etched a long gash into this valuable soil. Something can be done about checking erosion in gullies but it should be remembered that sheet erosion on the higher cultivated and overgrazed slopes preceded the formation of these fissures.

Temporary check dams, as shown in this picture, slow down the rush of water, thus allowing vegetation to take hold. Brush, logs, wire, sod, and some other materials may be used to build dams. The wire check dam is probably the most popular type because it is both effective and inexpensive.

Permanent dams of concrete, rock, or earth may be used where vegetation cannot take hold or where the value of the land to be protected warrants greater expense.

This picture was taken in November 1934 after check dams were in place. Black locust trees were planted on the gully banks the same year.

IN JUNE 1936 another picture, shown above, was taken of the Iowa gully on the preceding page. It will be seen that black locust trees, along with the grasses and the temporary check dams, are doing their work. The gully is being stabilized and its advance into the upland soil has been checked.

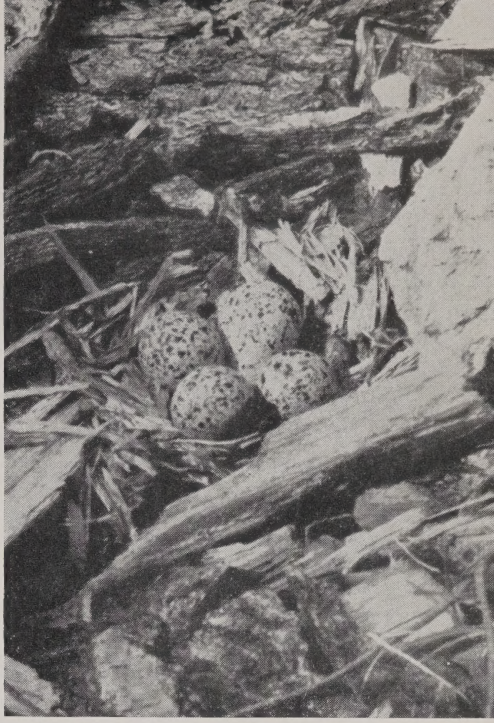
Stabilizing gullies often protects highways and road culverts from serious damage.

The black locust tree has an extensive root system that binds the soil and reduces erosion damage. It is a legume; therefore, it improves the soil by adding nitrogen. Furthermore, black locusts grow rapidly, and thus provide some cash income within 10 to 15 years from the sale of fence posts. Gullied land that otherwise would be a liability will bring cash or other returns to the farmer growing black locust trees.

Often badly eroded and formerly cultivated fields are returned to pasture either because the soil has become unproductive or because the gullies are so deep that farm implements cannot be used satisfactorily. These fields are frequently overgrazed to the extent that erosion goes on unchecked.

CONTOUR furrowing in pastures is practiced on some farms to hold water and soil. Usually the furrows are level with closed ends. The idea is to keep all of the water at or near the place where it falls. The picture above, taken soon after a heavy rain, shows water concentrated in three of the level furrows. Note the absence of water in the drainage ditch in the background.

THE UPPER MISSISSIPPI Valley region of the Soil Conservation Service includes five States, Illinois, Iowa, Minnesota, Missouri, and Wisconsin. According to the annual report of the National Resources Board for 1934 these five States have within their borders 63.6 percent of the grade 1 farm land of the United States.



THIS KILDEER plover built her nest in a woodpile back of the CCC camp near Coon Creek, Wis. Boys in the camp were careful not to molest such a resourceful creature and she was permitted to hatch the four eggs shown at the right. Experts who have tried getting pictures of a kildeer claim these photographs represent a rare accomplishment.

The increase in cultivation and the removal of timber and brush patches during the past several years have depleted both soil resources and wildlife population. Restoration of steep and eroded patches to trees and brush will help to solve the soil-erosion problem and likewise provide cover for species of wildlife that are now almost extinct. Fenced-in patches around planted gullies and areas immediately adjacent to earth-mound stock-water tanks, will afford additional cover for wildlife.

Quail and pheasants are considered among the most beneficial game birds in this region.

THE FOREGOING illustrations and text depict the causes of serious erosion and some of the practices that farmers are using to retard soil loss. In the upper Mississippi Valley the problem is essentially that of saving the soil that remains.

The Soil Conservation Service of the United States Department of Agriculture demonstrates measures of defense against erosion by wind and water. Demonstration areas, each covering from 25,000 to 150,000 acres, have been established in 43 States. The purpose is to show how soil losses may be averted through better cropping systems, changes in tillage practices, terracing, strip cropping, contour farming, contour furrowing in pastures, gully control, by retiring badly eroded land to trees or grass, and by other measures tested by experiment stations and farmers.

Groups of farmers from nearby areas often visit these demonstrations so that they may observe soil-saving practices, and talk with the farmer who owns or operates the farm. The picture above shows a group of Montgomery County, Mo., farmers inspecting some wire check dams built about 1 year previous to their visit. The location of demonstration areas for the upper Mississippi Valley, along with the CCC camps that are doing erosion-control work, are listed on the next page.

Upper Mississippi Valley Region of the Soil Conservation Service

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DEMONSTRATION AREAS

LeRoy, Ill.
Edwardsville, Ill.
Freeport, Ill.
Shenandoah, Iowa
McGregor, Iowa
Cedar Rapids, Iowa
Knoxville, Iowa
Greenfield, Iowa
Lamoni, Iowa.
Winona, Minn.
Spring Valley, Minn.
Caledonia, Minn.
Faribault, Minn.
Bethany, Mo.
Kahoka, Mo.
Washington, Mo.
Fulton, Mo.
Tarkio, Mo.
Coon Valley, Wis.
Fennimore, Wis.
Independence, Wis.

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SCS—CCC CAMPS

Illinois has 28 camps; Iowa, 21; Minnesota, 12; Missouri, 22; and Wisconsin, 17; total, 100.

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EROSION EXPERIMENT STATIONS

Dixon Springs, Ill.; Bethany, Mo.; LaCrosse, Wis.; Fulton, Mo.; and Clarinda, Iowa.

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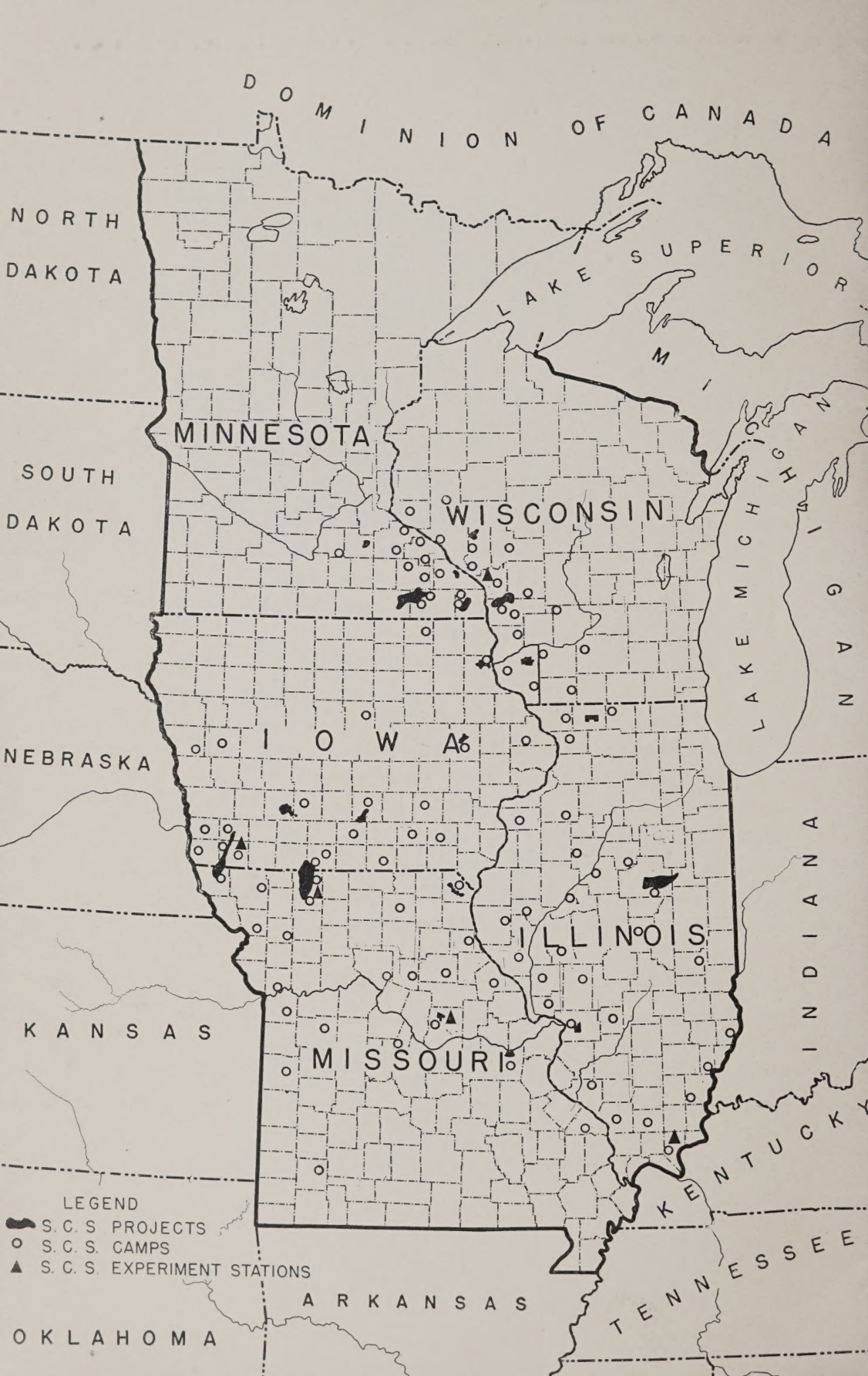
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